

Network Edge Computing- Using, learning and cultivating best practices to meet the challenges of next-generation high performance embedded computing

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Abstract

Boeing is one of the key players in Network-Centric Operations (NCO) in which shared situational awareness is created by networking operational agents based on common operating information and setting up local agents to make quick decisions with increase speed of operations and computing resource sharing. In August 2004, with leadership from Boeing, a Network Centric Operations Industry Consortium (NCOIC) was formed. The NCOIC currently has a membership of 80 organizations that are the premier leaders in the aerospace, defense, information technology, large-scale integrator and services industries. These organizations are currently developing and/or involved in various technology development to support NCO platforms.

The technologies and market for wireless networks are pushing the envelope to look for cognitive and intelligent networks to support the NCO needs with use of underlying computing and network technologies. Edge of the network computing technologies are going to be the backbone for a new generation of high performance embedded computing that can support distributed network-centric real-time applications in commercial and military markets.

The architectural base for the peer-to-peer network computing engine is the *computing fabric* to implement sensor nodes. This fabric is dynamically reconfigurable and has more fluidity than a fixed grid infrastructure. Since higher levels of chip integration exist today in silicon, the possibility of massive integration of these fabric sensor nodes on a chip is realizable in the near future with key advantages of low-power awareness, reduced cost, increased performance and dynamic adaptability. Boeing, in collaboration with a leading computing technology industry leader, is evaluating architecture and platform environments for adaptable embedded high performance solutions capable of running applications on the dynamic NCO networks.

In this paper, we discuss some general needs for a computing engine to support high performance embedded distributed computing applications. We also present and discuss several high performance distributed architecture methodologies, including high level abstraction modeling and validation tools needed to access the usability of the emerging embedded technology. We also briefly will discuss what challenges are ahead for bringing together HPC architects, silicon architects and application developers to address the high performance embedded computing market, and we will provide some general insights into the challenges ahead for migration of the intelligent edge computing onto a system-on-a-chip for alignment with the current System-on-a-Chip (SoC) development in general.

References:

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Author's Biography



Tirumale K Ramesh is currently a Senior Scientist and Associate Technical Fellow with the Boeing Space & Intelligence Systems. He has over 25 years of professional experience specifically working in the area of parallel architectures, embedded computing systems, reconfigurable architectures and networks, and system-on-a chip level architecture and solutions. At Boeing, he is currently involved with several key technical activities including leading a major R&D project on high performance embedded intelligent peer-to-peer network computing. Prior to joining Boeing, he has served as Technical Lead at Lockheed Martin and IBM Microelectronics. Dr. Ramesh is a Senior Member of IEEE and IEEE Computer Society and serves on the executive committee of the IEEE Computer Society Technical Activities Board. He served on the technical committees of Military & Aerospace PLD conference (MAPLD 2006) and is presently serving on the program committee of the Mini-Symposium on HPC at HiPC 2006 conference. Dr. Ramesh is widely published and has several patents pending in the area of reconfigurable and embedded computing. Dr. Ramesh earned his BSEE from Bangalore University, India, MSEE from Mississippi State University with concentration in VLSI and a Ph.D degree in Computer Engineering from Oakland University, Michigan.



John L Meier is a Boeing Technical Fellow in the Network Centric Thrust at Phantom Works, NCO Thrust. He has over 27 years of professional experience in avionic technology development specifically working in the area of intelligent networking, reconfigurable computing architectures and wireless network management. At Boeing, he is currently involved with several key technical activities including a major project on edge computing and intelligent distributed system management. Mr. Meier earned his BS from Southern Illinois University - Carbondale (SIU-C), MS University of Missouri - Rolla (UMR), and currently working on his PhD degrees from the Department Computer Science Engineering (CSE) at the Washington University in St. Louis. He is a member of IEEE and Tau Beta Pi.